

# Prolonged lifetime for orthopedic implants

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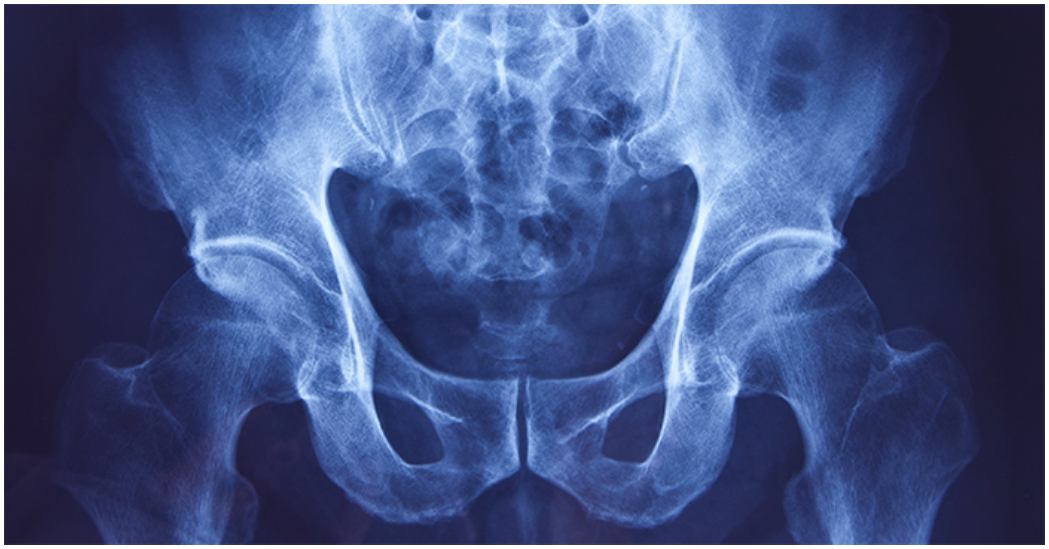

# Prolonged lifetime for orthopedic implants

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By Lisbeth Lassen

Populations in modern societies have an increased expected lifetime, as the development has been in Denmark for the last 16 years, and so accordingly the number of patients in need of orthopaedic implants surgery will increase in the future.

The project ArthroLube at DTU Mechanical Engineering has just received DKK 2 million from Villum Fonden's programme Villum Experiments seeks to improve the lifetime of joint implants by means of fluid lubricants, rather than improving implant materials properties. Focus of the research activities will be on analyzing wear debris from the implants and on biocompatibility tests on cells and animals. The research in ArthroLube is also expected to form a basis for further drug development.

**How compatible is an implant with the human body?**

When an implant lacks compatibility with the human body, it will lead to various sufferings and illnesses for the patient, and in relation to orthopedic implants, the problems are mainly due to wear. Orthopedic implants are functioning under persistent loading and shear stress, unlike most other implants. Because of this, wear, and especially the particles released into the tissue as a result this, is an important problem leading to the failure of the implants. When, for example, the wear particles from specific types of polyethylene from the artificial hip joint are released into the surrounding tissue, this is known to trigger reactions in the immune system, and reactions that will lead to disintegration of the bones surrounding the implant, and finally leading to the loosening of the implant. Wear particles from metal – on – metal joints are known to elevate chromium and cobalt levels in the patient's serum and urine, raising the risk for developing cancer.

Almost all wear particles are generated from the friction that arises when the surfaces of the implant move against each other every time the joint is moved. How compatible an implant is with the body and for how long the implant will remain stable, are part of the same problem.

**Finding the right lubricant for prosthetic joints**

Many research efforts have been put into the development of new materials for prosthetic joints, in the search for reducing the problems related to wear and wear particles. In the project ArthroLube, the researchers have a very different approach, aiming to reduce the wear by administering fluidic lubricants to

the prosthetic joints, and not by developing new materials for the implants. This approach has not been possible until recently, because no lubricants that were compatible with the human body were available. But recent studies at DTU have shown that a variety of water-soluble macromolecules, can in fact effectively lubricate engineering materials in an aqueous environment like the human body.

Associate Professor Seunghwan Lee from DTU Mechanical Engineering is project leader of ArthroLube. Seunghwan Lee has been involved in several project focusing on biomimetic lubrication and biotribological properties of different materials.